"Express Mail" mailing label number:

EL153098168

MODULAR BAY ENCLOSURE REMOVABLE CARD METHOD AND SYSTEM

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates, in general, to a method and system to be utilized in data processing systems.

Description of the Related Art

Data processing systems are systems that manipulate, process, and store data and are notorious within the art. Personal computer systems, and their associated subsystems, constitute well known species of data processing systems.

Personal computer systems typically include a motherboard for mounting at least one microprocessor and other application specific integrated circuits (ASICs), such as memory controllers, input/output (I/O) controllers, and the like. Most motherboards include slots for additional adapter cards to provide additional function to the computer system. Typical functions that a user might add to a computer include additional microprocessors, additional memory, fax/modem capability, sound cards, graphics cards, or the like. The slots included on the motherboard generally include in-line electrical connectors having electrically conductive lands which receive exposed tabs on the adapter cards. The lands are connected to wiring layers, which in turn are connected to a bus that allows the cards to communicate with the microprocessor or other components in the system.

A personal computer system may include many different types of buses to link the various components of the system. Examples of such buses are a "local bus"

which connects one or more microprocessors to the main memory, an Industry Standard Architecture (ISA) bus for sound cards and modems, a Universal Serial Bus (USB) for pointing devices, scanners, and digital cameras, a Fire Wire (IEEE-1394) for digital video cameras and high-speed storage drives, and a Peripheral Component Interconnect (PCI) bus for graphics cards, SCSI adapters, sound cards, and other peripheral devices such as isochronous devices, network cards, and printer devices.

As noted, a computer system may include a PCI bus. A PCI bus is a bus compliant with the PCI bus standard promulgated by the PCI special interest group (an unincorporated association of members of the microcomputer industry set up for the purpose of monitoring and enhancing the development of the Peripheral Component Interconnect (PCI) architecture). Specific PCI standards are available within PCI Spec. Rev. 2.1, available from the PCI special interest group, which is hereby incorporated by reference in its entirety.

Under the PCI bus specification, peripheral components can directly connect to a PCI bus without the need for glue logic. Thus, PCI is designed to provide a bus specification under which high-performance peripheral devices, such as graphics devices and hard disk drives, can be coupled to the CPU, thereby permitting these high-performance peripheral devices to avoid the general access latency and the band-width constraints that would have occurred if these peripheral devices were connected to a low speed peripheral bus.

The PCI bus standard is extremely extensive, and specifies aspects of many components related to the PCI standard. One such aspect is the physical form (e.g., physical height, width and depth) of each PCI specified component. Examples of PCI components which have specified "form factors" are PCI sockets, or slots, which are utilized to allow PCI cards (devices) to plug into, or interface with, any particular PCI bus.

Those skilled in the art will recognize that the various specified form factors for PCI cards and slots are not very amenable for implementation in smaller, more compact computers (e.g., small desktop, laptop, notebook, and sub-notebook

computers). There has therefore been a move within the industry to implement the capabilities of PCI within smaller and smaller form factors. Examples of such movement are the Compact PCI and Small PCI standards, well known to those within the art.

A latest movement toward smaller form factors has been termed "mini-PCI". The mini-PCI standard is being created to allow PCI functionality to be deployed in very small volume enclosures, such as small desktop, laptop, notebook, and sub-notebook computers. The mini-PCI standard is contained within the *Mini PCI Specification*, Revision .8 (16 March 1999) ("mini-PCI specification"), hereby incorporated by reference in its entirety.

Mini-PCI is being designed to be an internal, "under-the-covers" solution for hardware designers and OEMs. Under the Mini-PCI standard, it is envisioned that Mini-Cards are removable and upgradadable with "new technology cards," but it is envisioned that such removal and upgrade will be performed by a qualified technician. (One reason that this is true is that the Mini-PCI specification assumes that the Mini-PCI cards will be installed on a motherboard, and thus swapping out a Mini-PCI card will require that the main board be accessed and manipulated.) Consequently, Mini-PCI does not provide for the robust, encased design of a swappable, end-user solution such as standard PCI sockets and standard PCI cards.

SUMMARY OF THE INVENTION

A system and method have been invented which provide Mini-PCI with a robust, encased design of a swappable, end-user solution analogous to that available with standard PCI sockets and standard PCI cards. In one embodiment, the method and system include a modular bay having a removable-card connector. In another embodiment, the method and system further include a removable card. In yet another embodiment, the method and system include a mini-Peripheral Component Interconnect connector, and a modular bay enclosure containing the mini-Peripheral Component Interconnect connector.

The foregoing is a summary and thus contains, by necessity, simplifications, generalizations and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the present invention, as defined solely by the claims, will become apparent in the non-limiting detailed description set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings.

Figure 1 depicts a pictorial representation of a data-processing system which can be utilized in accordance with the method and system of an illustrative embodiment of the present invention.

Figure 2 illustrates a representative hardware environment, which incorporates a graphical user interface, which can be utilized in accordance with the method and system of an illustrative embodiment of the present invention.

Figure 3 shows a high-level component diagram depicting a data processing system which illustrates another environment wherein one or more embodiments of the present invention may be practiced.

Figure 4 illustrates data processing system **120** having module bay **402**.

Figure 5A depicts a cut-away perspective view of module bay **402** containing mini-PCI connector **500** and mini-PCI card **502.**

Figure 5B shows a cut-away perspective view of module bay **402** wherein is illustrated within module bay **402** mini-PCI card **502** locked in place within mini-PCI connector **500**.

Figure 6 shows a perspective view of module bay **402** partially inserted within module-bay-to-docking station adapter **620,** where module-bay-to-docking station adapter **620** is depicted partially inserted within docking station **600**.

The use of the same reference symbols in different drawings indicates similar or identical items.

DETAILED DESCRIPTION

The following sets forth a detailed description of the best contemplated mode for carrying out the multiple independent inventions described herein. The description is intended to be illustrative and should not be taken to be limiting. In addition, the following detailed description has been divided into sections (e.g., sections I-II) in order to highlight the invention described herein; however, those skilled in the art will appreciate that such sections are merely for illustrative focus, and that the invention herein disclosed typically draws its support from multiple sections. Consequently, it is to be understood that the division of the detailed description into separate sections is merely done as an aid to understanding and is in no way intended to be limiting.

I. ENVIRONMENT

With reference now to the figures and in particular with reference now to **Figure 1**, there is depicted a pictorial representation of a data-processing system which can be utilized in accordance with the method and system of an illustrative embodiment of the present invention. A graphical user interface system and method can be implemented with the data-processing system depicted in **Figure 1**. A data processing system **120** is depicted which includes a system unit **122**, a video display device **124**, a keyboard **126**, a mouse **128**, and a microphone **148**. Data processing system **120** may be implemented utilizing any suitable computer such as an IBM-compatible or an Apple-compatible computer.

Figure 2 is an illustration of a representative hardware environment, which incorporates a graphical user interface. **Figure 2** depicts selected components in data processing system **120** in which an illustrative embodiment of the present invention may be implemented. Data processing system **120** includes a Central Processing Unit ("CPU") **231**, such as a conventional microprocessor, and a number of other units interconnected via system bus **232**. Such components and units of data processing system **120** can be implemented in a system unit such as unit **122** of **Figure 1**. Data

processing system **120** includes random-access memory ("RAM") **234**, read-only memory ("ROM") **236**, display adapter **237** for connecting system bus **232** to video display device **124**, and I/O adapter **239** for connecting peripheral devices (e.g., disk and tape drives **233**) to system bus **232**. Video display device **124** is the visual output of data processing system **120**, which can be a CRT-based video display well-known in the art of computer hardware. However, with a portable or notebook-based computer, video display device **124** can be replaced with an LCD-based or a gas plasma-based flat-panel display. Data processing system **120** further includes user interface adapter **240** for connecting keyboard **126**, mouse **128**, speaker **246**, microphone **148**, and/or other user interface devices, such as a touch screen device (not shown), to system bus **232** through I/O adapter **239**. Communications adapter **249** connects data processing system **120** to a data-processing network.

Any suitable machine-readable media may retain the graphical user interface, such as RAM **234**, ROM **236**, a magnetic diskette, magnetic tape, or optical disk (the last three being located in disk and tape drives **233**). Any suitable operating system and associated graphical user interface (e.g., Microsoft Windows) may direct CPU **231**. Other technologies can also be utilized in conjunction with CPU **231**, such as touch-screen technology or human voice control. In addition, data processing system **120** includes a control program **251** which resides within computer storage **250**. Control program **251** contains instructions that when executed on CPU **231** carries out application program (e.g., videoconferencing software) operations.

Those skilled in the art will appreciate that the hardware depicted in **Figure 2** may vary for specific applications. For example, other peripheral devices such as optical disk media, audio adapters, or programmable devices, such as PAL or EPROM programming devices well-known in the art of computer hardware, and the like may be utilized in addition to or in place of the hardware already depicted.

Those skilled in the art will recognize that data processing system **120** can be described in relation to data processing systems which perform essentially the same

functionalities, irrespective of architectures. As an example of such, an alternative partial architecture data processing system **120** is set forth in **Figure 3**.

Referring now to **Figure 3**, shown is a high-level component diagram depicting a partial data processing system **120** which illustrates another environment wherein one or more embodiments of the present invention may be practiced. Shown are AGP-enabled graphics controller **300**, AGP interconnect **302** (a data bus), and AGP-enabled Northbridge **304**. Not shown, but deemed present is an AGP-enabled operating system. The term AGP-enabled is intended to mean that the so-referenced components are engineered such that they interface and function under the standards defined within the AGP interface specification (Intel Corporation, *Accelerated Graphics Port Interface Specification*, Revision 1.0 (31 July 1996)). Further depicted are video display device **124**, local frame buffer **312**, Central Processing Unit (CPU) **231** (wherein are depicted microprocessor **309**, L1 Cache **311**, and L2 Cache **313**), CPU bus **315**, system memory **316**, Peripheral Component Interconnect (PCI) bus **318**, various PCI Input-Output (I/O) devices **350, 352,** and **354**, Southbridge **322**, 1394 Device **325**, and network card **327**.

The foregoing components and devices are used herein as examples for sake of conceptual clarity. As for (non-exclusive) examples, CPU **231** is utilized as an exemplar of any general processing unit, including but not limited to multiprocessor units; CPU bus **315** is utilized as an exemplar of any processing bus, including but not limited to multiprocessor buses; PCI devices **350-354** attached to PCI bus **318** are utilized as an exemplar of any input-output devices attached to any I/O bus; AGP Interconnect **302** is utilized as an exemplar of any graphics bus; AGP-enabled graphics controller **300** is utilized as an exemplar of any graphics controller; Northbridge **304** and Southbridge **322** are utilized as exemplars of any type of bridge; 1394 device **325** is utilized as an exemplar of any type of isochronous source; and network card **327**, even though the term "network" is used, is intended to serve as an exemplar of any type of synchronous or asynchronous input-output cards. Consequently, as used herein these specific exemplars are intended to be representative of their more general classes. Furthermore, in general, use of any

specific exemplar herein is also intended to be representative of its class and the non-inclusion of such specific devices in the foregoing list should not be taken as indicating that limitation is desired.

Generally, each bus utilizes an independent set of protocols (or rules) to conduct data (e.g., the PCI local bus specification and the AGP interface specification). These protocols are designed into a bus directly and such protocols are commonly referred to as the "architecture" of the bus. In a data transfer between different bus architectures, data being transferred from the first bus architecture may not be in a form that is usable or intelligible by the receiving second bus architecture. Accordingly, communication problems may occur when data must be transferred between different types of buses, such as transferring data from a PCI device on a PCI bus to a CPU on a CPU bus. Thus, a mechanism is developed for "translating" data that are required to be transferred from one bus architecture to another. This translation mechanism is normally contained in a hardware device in the form of a bus-to-bus bridge (or interface) through which the two different types of buses are connected. This is one of the functions of AGP-enabled Northbridge **304**, Southbridge **322**, and other bridges shown in that it is to be understood that such can translate and coordinate between various data buses and/or devices which communicate through the bridges.

II. MODULAR BAY

With reference now to **Figure 4**, illustratively shown is data processing system **120** having module bay **402** (also known in the art as a media bay, or a modular bay). Depicted is that module bay **402** to be inserted into module bay receptor slot **404**.

Referring now to **Figure 5A**, depicted is a cut-away perspective view of module bay **402**. Illustrated within module bay **402** is mini-PCI connector **500**. Those skilled in the art will recognize that mini-PCI connector **500** is exemplary of removable-card connectors, such as mini-PCI connectors (e.g., Type 1, 2, 3, etc.) called out in *Mini PCI Specification*, Revision .8 (16 March 1999) ("mini-PCI

specification"), hereby incorporated by reference in its entirety. Depicted is that partially inserted into mini-PCI connector **500** is mini-PCI card **502**. Those skilled in the art will recognize that mini-PCI card **502** is exemplary of removable cards, such as mini-PCI cards (e.g., Type 1, 2, 3, etc.) called out in the mini-PCI specification. Illustrated is module connector **504**, well known to those within the art, which can be utilized to interface with a mating connector (not shown) within data processing system **120.** Those skilled in the art will recognize that module connector **504** is exemplary of many various types of connectors (e.g., male and female pin-type connectors, male and female board-edge connectors, and wireless connectors such as infrared or radio frequency connectors) used in the art of data processing. Not shown, but assumed to be present, is an electrical connection between mini-PCI connector **500** and module connector **504** sufficient to allow module connector **504** to provide the appropriate electrical and logical connections to the pins of mini-PCI connector **500** (which pins will be utilized will vary with different applications).

Further depicted are connectors which are exemplary of a few ways in which the capabilities of mini-PCI card **502** may be utilized. Illustrated are audio connector **506**, video connector **508**, ethernet connector **510** (e.g., an RJ45 connector), and modem connector **512** (e.g., an RJ11 connector). However, those skilled in the art will recognize that the connections shown are merely exemplary and that other connectors appropriate to the functionalities of the mini-PCI cards called out in the mini-PCI specification are also intended to be viewed as within the scope of the connectors depicted.

Referring now to **Figure 5B**, shown is a cut-away perspective view of module bay **402**. Illustrated within module bay **402** is mini-PCI card **502** locked in place within mini-PCI connector **500**.

With reference now to **Figure 6**, shown is perspective view of module bay **402** partially inserted within module-bay-to-docking station adapter **620,** where module-bay-to-docking station adapter **620** is depicted partially inserted within docking station **600**.

The use of module bay **402** with docking station **600** can be utilized to extend the capabilities of mini-PCI card **502**. It is assumed that a mating connector (not shown) exists within docking station **600** sufficient to interface with module connector **504**. Those skilled in the art will recognize that module connector **504** is exemplary of many various types of connectors (e.g., male and female pin-type connectors, male and female board-edge connectors, and wireless connectors such as infrared or radio frequency connectors) used in the art of data processing. Those skilled in the art will recognize that a portable computer (not shown) would typically dock with docking station **600** via docking station connector **650.**

The foregoing described embodiments depict different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely exemplary, and that in fact many other architectures can be implemented which achieve the same functionality. In an abstract, but still definite sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected", or "operably coupled", to each other to achieve the desired functionality.

Other embodiments are within the following claims.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the appended claims. It will be understood by those within the art that if a specific number of an introduced claim element is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such limitation

is present. For non-limiting example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim elements. However, the use of such phrases should not be construed to imply that the introduction of a claim element by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim element to inventions containing only one such element, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an"; the same holds true for the use of definite articles used to introduce claim elements.